

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY


(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 27 FEB 2006

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Applicant's or agent's file reference 075903-431	<b>FOR FURTHER ACTION</b> See Form PCT/PEA/416	
International application No. PCT/US2005/008212	International filing date (day/month/year) 10.03.2005	Priority date (day/month/year) 10.03.2004
International Patent Classification (IPC) or national classification and IPC H01L29/737, H01L21/331, H01L21/316, H01L29/10		
Applicant AGERE SYSTEMS INC. et al.		
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input type="checkbox"/> sent to the applicant and to the International Bureau) a total of sheets, as follows:</p> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>		
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input checked="" type="checkbox"/> Box No. VIII Certain observations on the international application</p>		
Date of submission of the demand  14.10.2005	Date of completion of this report  23.02.2006	
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer  Berthold, K  Telephone No. +49 89 2399-	



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**Box No. I Basis of the report**

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1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

**Description, Pages**

1-10 as originally filed

**Claims, Numbers**

1-33 as originally filed

**Drawings, Sheets**

1-9 as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	5,15,18,21,23,25,33
	No: Claims	1-4,6,7-14,16,17,19,20,22,24,26-32
Inventive step (IS)	Yes: Claims	
	No: Claims	1-33
Industrial applicability (IA)	Yes: Claims	1-33
	No: Claims	

2. Citations and explanations (Rule 70.7):

**see separate sheet**

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**Box No. VIII Certain observations on the international application**

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The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

Re Item V.

1 Reference is made to the following documents:

- D1: US 2003/189239 A1 (KALNITSKY ALEXANDER ET AL) 9 October 2003
- D2: EP 0 490 111 A (INTERNATIONAL BUSINESS MACHINES CORPORATION)  
17 June 1992 (1992-06-17)
- D3: US 6 686 250 B1 (KALNITSKY ALEXANDER ET AL) 3 February 2004
- D4: EP 0 435 135 A (TEXAS INSTRUMENTS INCORPORATED) 3 July 1991
- D5: US 6 437 376 B1 (OZKAN CENGİZ S) 20 August 2002
- D6: "CHEM-MECH POLISH FOR SELF-ALIGNED EMITTER/BASE ISOLATION IN  
SINGLE POLY EPI-BASE TRANSISTORS" IBM TECHNICAL DISCLOSURE  
BULLETIN, IBM CORP. NEW YORK, US, vol. 35, no. 5, 1 October 1992, pages  
208-210, XP000312937 ISSN: 0018-8689
- D7: US-A-3 725 161 (KUPER A,US) 3 April 1973
- D8: LIOU H K ET AL: "EFFECTS OF GE CONCENTRATION ON SIGE OXIDATION  
BEHAVIOR" APPLIED PHYSICS LETTERS, AMERICAN INSTITUTE OF  
PHYSICS. NEW YORK, US, vol. 59, no. 10, 2 September 1991, pages 1200-  
1202, XP000324711 ISSN: 0003-6951

2 INDEPENDENT CLAIMS 1,13,17,19,31

2.1 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1,13,17,19,31 is not new in the sense of Article 33(2) PCT. Document D1 discloses (see Figure 3, sections 24-30, claim 8): a hetero junction bipolar transistor, forming a Si collector (110), a p-SiGe base (108), a germanium enriched region proximate to the upper surface of the base and within the SiGe layer (implicit to a skilled person that a Ge pile-up is present, since the oxide (118) is formed by thermally oxidizing the p-SiGe layer, see section 25 and claim 8, resulting in a Ge enriched region as generally known by the skilled person, see e.g. D6, page 209; or D7, Fig. 13 and associated description; or D8, Fig. 2 and associated description), removing the oxide by an HF-dip, forming a polysilicon emitter (128). The subject-matter of claims 1, 13,17,19, 31 therefore lacks novelty.

2.2 The present application does not meet the criteria of Article 33(1) PCT, because the

subject-matter of claims 1,13,17,19,31 is not new in the sense of Article 33(2) PCT. Document D2 discloses (see col. 7, line 39 - col. 8, line 40, Figs. 1-10) a SiGe hetero junction bipolar transistor, forming a Si collector (5), forming a p-SiGe base (17), thermally growing an oxide layer (18) at 1 atm and 500-700 °C on a SiGe base, a germanium enriched region (implicit since the thermal oxidation of SiGe inherently results in a Ge pile-up as generally known by a skilled person (see e.g. D6, page 209; or D7, Fig. 13 and associated description; or D8, Fig. 2 and associated description), removing the oxide (HF etch) depositing an emitter polysilicon. The subject-matter of claims 1,13,17,19,31 therefore lacks novelty.

2.3 The applicant's attention is further drawn to documents D3 (see Fig. 2 and associated description) or D4 (see Figs. 2,6 and associated description) or D5 (see Figs. 1,4,11,13 and associated description) anticipating in substance the features of claims 1,13,17,19,31, since these documents disclose the fabrication of an HBT on a Si substrate, a thermal oxidation of the P-SiGe base resulting implicitly to a Ge pile-up as generally known by the skilled person (see e.g. D6, page 209; or D7, Fig. 13 and associated description; or D8, Fig. 2 and associated description documents D6, D7, or D8), removal of the oxide, a deposition of an emitter polysilicon. The subject-matter of claims 1,13,17,19,31 therefore lacks novelty.

2.4 Even if novelty of claims 1,13,17,19,31 were accepted in view of the fact that D1-D5 do not explicitly disclose "germanium enriched region", the subject-matter of claims 1,13,17,19,31 lacked an inventive step (Art. 33(3) PCT) since a skilled person would use thermal oxidation as suggested in D1-D5 and automatically arrive at a germanium pile-up near the surface of the p-SiGe base since thermal oxidation will cause a Ge pile-up as generally known (see e.g. documents D6, page 209; or D7, Fig. 13 and associated description; or D8, Fig. 2 and associated description).

### 3 DEPENDENT CLAIMS 2-12,14-16,18,20-30,32,33

Dependent claims do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step (Article 33(2) and (3) PCT) for the following reasons: The general term "low level of defects" covers the arrangements of D1 -D5. Grading of the Ge content is known from D2, p - SiGe is known from D1 or D2, 700°C is

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(SEPARATE SHEET)**

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known from D2, removing the oxide is known from D1-D5, graded Ge is known from D2, Ge concentrations inherently result in a band gap variation, strain in SiGe-Si epitaxial layers of D1-D5 is inherent.

Lack of inventive step: A Ge concentration between 30 and 75 and a band offset of greater than 0.21 eV represent simple design options (Art. 33(3) PCT) and fall within the competence of a skilled person.

The subject-matter as defined in claims 1-33 is obviously susceptible of industrial application.

**Re Item VIII.**

Claims 1,13,17 and claims 19,31 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought and in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness and as such do not meet the requirements of Article 6 PCT.